



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,419	09/30/2003	John M. Kulp	CT-001	6182
37694	7590	02/21/2006	EXAMINER	
WOOD, HERRON & EVANS, LLP (TOKYO ELECTRON) 2700 CAREW TOWER 441 VINE STREET CINCINNATI, OH 45202			CHACKO DAVIS, DABORAH	
		ART UNIT	PAPER NUMBER	
			1756	

DATE MAILED: 02/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/675,419	KULP, JOHN M.
	Examiner	Art Unit
	Daborah Chacko-Davis	1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 09/30/2003.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-36 is/are pending in the application.
 - 4a) Of the above claim(s) 36 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-35 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/03, 06/05</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-35, are drawn to a method, classified in class 430, subclass 311.
 - II. Claim 36, is drawn to an apparatus, classified in class 396, subclass 564.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process can be performed in a pulsed laser deposition system.
3. Because these inventions are independent or distinct for the reasons given above and the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Ms. Kristi L. Davidson on February 14, 2006, a provisional election was made without traverse to prosecute the invention of Group I, claims 1-35. Affirmation of this election must be made by applicant in replying to this Office action. Claim 36 is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1, 3, 11, 14, 17, and 19, are rejected under 35 U.S.C. 102(e) as being anticipated by U. S. Patent No. 6,472,127 (Takizawa).

Takizawa, in the abstract, in col 5, lines 56-67, in col 6, lines 8-10, and lines 26-36, in col 7, lines 1-17, disclose a method for developing a resist film formed on a substrate wherein an aqueous solution of a surfactant is applied onto the photoresist film, followed by displacing the surfactant film formed by applying the developing solvent of a predetermined concentration on the photoresist film to develop the photoresist film (claim 1). Takizawa, in col 9, lines 40-46, in col 10, lines 20, in col 11, lines 5-10, discloses that the surfactant employed includes anionic surfactants, cationic surfactants, and nonionic surfactants (claim 3). Takizawa, in col 6, lines 32-45, and in figure 7, discloses that the substrate is rotated during the application of the surfactant solution (spin coating the surfactant solution) onto the photoresist film, wherein the solution of the surfactant is supplied onto the resist surface via a cylindrically-shaped nozzle, and depositing the surfactant in a circular shaped manner (see figure 7) on the resist film, said nozzle positioned over the center of the substrate (substrate rotated while being

deposited with the aqueous surfactant solution) (claim 11). Takizawa, in col 6, lines 37-55, in col 7, lines 7-20, and in figure 12, discloses that the surfactant is spin coated in a drop-wise manner onto the center portion of the resist coated substrate, followed by spin coating the developing solution (displacing the surfactant) via a cylindrically-shaped nozzle onto the center of the rotating substrate (resist film treated with surfactant) wherein the developing solvent is sprayed in a circular manner (see figure 12) for a predetermined time so as to cause the developing solvent component to be reattached to the surface of the photoresist film (claims 14, 17, and 19).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 2, 4-5, 9-10, and 18, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,472,127 (Takizawa) in view of U. S. Patent No. 6,136,514 (Phan et al., hereinafter referred to as Phan).

Takizawa is discussed in paragraph no. 6.

Takizawa discloses that the surfactant solution applied on the resist hydrophilicizes the exposed resist and thereby reduces the contact angle of the developing solution on the resist film (claim 5). Takizawa, in col 6, lines 45-67, in col 7,

lines 1-20, discloses that exposure of the resist film results in exposed and unexposed portions of the resist having a difference in the solubility (claim 9).

The difference between the claims and Takizawa is that Takizawa does not disclose determining the concentration for the surfactant solution based on one or more characteristics of the resist film(claim 2). Takizawa does not disclose determining the concentration of the surfactant solution based on the resist film, and selecting the concentration of the developing solution based on one or more characteristics of the surfactant solution (claim 4). Takizawa does not disclose determining the concentration of the surfactant solution based on the contact angle, solubility of the exposed portions and unexposed portions of the resist . Takizawa does not disclose that the concentration of the surfactant is based on the water solubility of the resist film (claim 10). Takizawa does not disclose that the concentration of the developing solution is selected based on characteristics of the surfactant and the resist film (claim 18).

Phan, in col 2, lines 10-45, in col 3, lines 27-67, discloses that the concentration of the surfactant solution (resist activating solution) is based the characteristics of the resist film and the water solubility of the resist film. Phan, in col 4, lines 1-22, in col 5, lines 46-67, in col 6, lines 1-7, discloses that concentration of the developing solution is based on the resist film characteristics and the resist activating solution properties.

Therefore, it would be obvious to a skilled artisan to modify Takizawa by employing the concentrations of surfactants and developing solutions suggested by Phan because Phan, in col 3, lines 28-59, discloses that the resist activating solution promotes the reduction of the surface tension of the developer, promotes hydrophilicity

of the resist film and thereby reduces contact angle, prevents the formation of micro bubbles during development.

9. Claims 6-8, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,472,127 (Takizawa) in view of U. S. Patent 5,845,170 (Ogata).

Takizawa is discussed in paragraph no. 6.

Takizawa, in col 6, lines 10-56, in col 7, lines 1-24, discloses positioning the resist coated film substrate on a support plate in a developing unit, wherein the supporting plate (spin chuck) is rotatably driven by a motor, applying and displacing the surfactant and developer respectively on the surface of the resist while substrate is rotated, and developing the resist film by applying the developing solution for a predetermined time (reattachment of the developing solvent component to the surface of the photoresist film) (claims 6-7).

The difference between the claims and Takizawa is that Takizawa does not disclose that the resist-coated substrate is transferred to the developing unit. Takizawa does not disclose rinsing and drying the substrate while rotating the spin chuck and transferring the substrate out of the developing unit (claim 8).

Ogata, in col 4, lines 57-67, in col 5, lines 30-37, in col 7, lines 61-67, discloses that the resist coated wafer is transferred to a developing unit. Ogata, in col 10, lines 6-36, discloses that after the developing process the wafer (rotated at a high speed) is rinsed with a cleaning solution followed by drying, and then releasing the wafer from the developing unit (carry out the wafer, reference S19 of figure 8).

Therefore, it would be obvious to a skilled artisan to modify Takizawa by employing the resist coating and developing system suggested by Ogata because Ogata, in col 4, lines 56-67, in col 7, lines 61-66, and in figure 2, discloses that the resist coated substrate is transferred to a developing unit and are communicable with each other via a vertical flow system, thereby enabling an increased efficient cleanliness of each part in the system. It would be obvious to a skilled artisan to modify Takizawa by employing the rinse process suggested by Ogata because Ogata, in col 10, lines 10-36, discloses that rinsing the developed wafer, while the wafer is rotated at high speed (S16) ensures the complete removal of the developing solution from the wafer surface.

10. Claims 12-13, 15-16, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. patent No. 6,472,127 (Takizawa) in view of U. S. Patent Application Publication No. 2004/0029026 (Hayasaki et al., hereinafter referred to as Hayasaki).

Takizawa is discussed in paragraph no. 6.

Takizawa, in col 6, lines 37-55, in col 7, lines 7-20, and in figure 12, discloses that the surfactant is spin coated via a nozzle onto the surface of the resist-coated substrate, followed by spin coating the developing solution (displacing the surfactant) via nozzle onto the surface of the rotating substrate (resist film treated with surfactant) wherein the developing solvent (of predetermined concentration, adjusted concentration) is sprayed in a circular manner (see figure 12) for a predetermined time so as to cause the developing solvent component to be reattached to the surface of the photoresist film (claims 12-13, and 15-16).

The difference between the claims and Takizawa is that Takizawa does not disclose that the nozzle used for dispensing either the surfactant or the developing solution includes a plurality of nozzles that dispenses the corresponding fluid in a substantially band shape, wherein the nozzles are scanned over the substrate while depositing the corresponding fluid.

Hayasaki, in [0056], [0057], [0058], [0061], [0065], [0068], [0069], and in figures 2, and 4, discloses the use of a rectangular shaped nozzle that includes a plurality of nozzle discharge ports and dispenses solutions (of predetermined concentration) in a band shape in a direction vertical (onto the surface of the substrate) to the nozzle scan direction.

Therefore, it would be obvious to a skilled artisan to modify Takizawa by employing a plurality of nozzles of the claimed geometry as suggested by Hayasaki because Hayasaki, in [0056], and [0057], discloses that such a nozzle arrangement enables a series of processes (treating, developing, cleaning etc) to be performed, is moveable vertically and horizontally to discharge a fluid while scanning the substrate, and dispenses the fluid in a uniform amount on the surface of the substrate.

11. Claims 20-21, 23-25, 28, 31, and 34-35, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,472,127 (Takizawa) in view of U. S. Patent No. 6,136,514 (Phan et al., hereinafter referred to as Phan).

Takizawa, in the abstract, in col 5, lines 56-67, in col 6, lines 8-10, and lines 26-

36, in col 7, lines 1-17, disclose a method for developing a resist film formed on a substrate wherein an aqueous solution of a surfactant is applied onto the photoresist film, followed by displacing the surfactant film formed by applying the developing solvent of a predetermined concentration on the photoresist film to develop the photoresist film. (claim 20). Takizawa, in col 9, lines 40-46, in col 10, lines 20, in col 11, lines 5-10, discloses that the surfactant employed includes anionic surfactants, cationic surfactants, and nonionic surfactants (claim 21). Takizawa discloses that the surfactant solution applied on the resist hydrophilicizes the exposed resist and thereby reduces the contact angle of the developing solution on the resist film (claim 25). Takizawa, in col 6, lines 32-45, and in figure 7, discloses that the substrate is rotated during the application of the surfactant solution (spin coating the surfactant solution) onto the photoresist film, wherein the solution of the surfactant is supplied onto the resist surface via a cylindrically-shaped nozzle, and depositing the surfactant in a circular shaped manner (see figure 7) on the resist film, said nozzle positioned over the center of the substrate (substrate rotated while being deposited with the aqueous surfactant solution) (claim 28). Takizawa, in col 6, lines 37-55, in col 7, lines 7-20, and in figure 12, discloses that the surfactant is spin coated in a drop-wise manner onto the center portion of the resist coated substrate, followed by spin coating the developing solution (displacing the surfactant) via a cylindrically-shaped nozzle onto the center of the rotating substrate (resist film treated with surfactant) wherein the developing solvent is sprayed in a circular manner (see figure 12) for a predetermined time so as to cause the developing

solvent component to be reattached to the surface of the photoresist film (claims 31, 34, and 35).

The difference between the claims and Takizawa is that Takizawa does not disclose determining the concentration for the surfactant solution based on one or more characteristics of the resist film. Takizawa does not disclose that the concentration of the developing solution is selected based on characteristics of the surfactant and the resist film. Takizawa does not disclose determining the concentration of the surfactant solution based on the resist film, and selecting the concentration of the developing solution based on the surfactant solution concentration (claim 23). Takizawa does not disclose determining the concentration of the surfactant solution based on the contact angle, solubility of the exposed portions and unexposed portions of the resist. Takizawa does not disclose that the concentration of the surfactant is based on the water solubility of the resist film (claim 24).

Phan, in col 2, lines 10-45, in col 3, lines 27-67, discloses that the concentration of the surfactant solution (resist activating solution) is based the characteristics of the resist film and the water solubility of the resist film. Phan, in col 4, lines 1-22, in col 5, lines 46-67, in col 6, lines 1-7, discloses that concentration of the developing solution is based on the resist film characteristics and the resist activating solution properties (including the concentration of the resist activating solution). Phan in col 6, lines 6-14, discloses rinsing the substrate surface after the development process.

Therefore, it would be obvious to a skilled artisan to modify Takizawa by employing the concentrations of surfactants and developing solutions suggested by

Phan because Phan, in col 3, lines 28-59, discloses that the resist activating solution promotes the reduction of the surface tension of the developer, promotes hydrophilicity of the resist film and thereby reduces contact angle, prevents the formation of micro bubbles during development. It would be obvious to a skilled artisan to modify Takizawa by employing the rinsing process suggested by Phan because Phan , in col 6, lines 5-15, discloses that the rinsing process enables the removal of all resist residues and developing solution remaining on the substrate surface.

12. Claim 22, is rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,472,127 (Takizawa) in view of U. S. Patent No. 6,136,514 (Phan et al., hereinafter referred to as Phan) as applied to claims 20-21, 23-25, 28, 31, and 34-35 above, and further in view of U. S. Patent Application Publication No. 2002/0058202 (Maemori et al., hereinafter referred to as Maemori).

Takizawa in view of Phan is discussed in paragraph no. 11.

The difference between the claims and Takizawa in view of Phan is that Takizawa in view of Phan does not disclose determining the concentration of the surfactant solution based on the resist film thickness (claim 22).

Maemori, in the abstract, in [0039], and [0042], discloses that the surfactant concentration is determined based on the resist film thickness formed on the substrate.

Therefore, it would be obvious to a skilled artisan to modify Takizawa in view of Phan by determining surfactant concentration based on the resist thickness as suggested by Maemori because Maemori in [0042], discloses that doing so ensures

good uniformity of the coating layer formed on the substrate surface and reduces considerably the defects in the finely patterned resist after development.

13. Claims 26-27, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,472,127 (Takizawa) in view of U. S. Patent No. 6,136,514 (Phan et al., hereinafter referred to as Phan) as applied to claims 20-21, 23-25, 28, 31, and 34-35, above, and further in view of U. S. Patent 5,845,170 (Ogata).

Takizawa in view of Phan is discussed in paragraph no. 11.

Takizawa, in col 6, lines 10-56, in col 7, lines 1-24, discloses positioning the resist coated film substrate on a support plate in a developing unit, wherein the supporting plate (spin chuck) is rotatably driven by a motor, applying and displacing the surfactant and developer respectively on the surface of the resist while substrate is rotated, and developing the resist film by applying the developing solution for a predetermined time (reattachment of the developing solvent component to the surface of the photoresist film) (claim 26).

The difference between the claims and Takizawa in view of Phan is that Takizawa in view of Phan does not disclose that the resist-coated substrate is transferred to the developing unit. Takizawa does not disclose drying the substrate while rotating the spin chuck and transferring the substrate out of the developing unit (claim 27).

Ogata, in col 4, lines 57-67, in col 5, lines 30-37, in col 7, lines 61-67, discloses that the resist coated wafer is transferred to a developing unit. Ogata, in col 10, lines 6-

36, discloses that after the developing process the wafer (rotated at a high speed) is rinsed, followed by drying, and then releasing the wafer from the developing unit (carry out the wafer, reference S19 of figure 8).

Therefore, it would be obvious to a skilled artisan to modify Takizawa in view of Phan by employing the resist coating and developing system suggested by Ogata because Ogata, in col 4, lines 56-67, in col 7, lines 61-66, and in figure 2, discloses that the resist coated substrate is transferred to a developing unit and are communicable with each other via a vertical flow system, thereby enabling an increased efficient cleanliness of each part in the system.

14. Claims 29-30, 32-33, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. patent No. 6,472,127 (Takizawa) in view of U. S. Patent No. 6,136,514 (Phan et al., hereinafter referred to as Phan) as applied to claims 20-21, 23-25, 28, 31, and 34-35 above, and further in view of U in view of U. S. Patent Application Publication No. 2004/0029026 (Hayasaki et al., hereinafter referred to as Hayasaki).

Takizawa is discussed in paragraph no. 6.

Takizawa, in col 6, lines 37-55, in col 7, lines 7-20, and in figure 12, discloses that the surfactant is spin coated via a nozzle onto the surface of the resist-coated substrate, followed by spin coating the developing solution (displacing the surfactant) via nozzle onto the surface of the rotating substrate (resist film treated with surfactant) wherein the developing solvent (of predetermined concentration, adjusted concentration) is sprayed in a circular manner (see figure 12) for a predetermined time

so as to cause the developing solvent component to be reattached to the surface of the photoresist film (claims 29-30, and 32-33).

The difference between the claims and Takizawa in view of Phan is that Takizawa in view of Phan does not disclose that the nozzle used for dispensing either the surfactant or the developing solution includes a plurality of nozzles that dispenses the corresponding fluid in a substantially band shape, wherein the nozzles are scanned over the substrate while depositing the corresponding fluid.

Hayasaki, in [0056], [0057], [0058], [0061], [0065], [0068], [0069], and in figures 2, and 4, discloses the use of a rectangular shaped nozzle that includes a plurality of nozzle discharge ports and dispenses solutions (of predetermined concentration) in a band shape in a direction vertical (onto the surface of the substrate) to the nozzle scan direction.

Therefore, it would be obvious to a skilled artisan to modify Takizawa in view of Phan by employing a plurality of nozzles of the claimed geometry as suggested by Hayasaki because Hayasaki, in [0056], and [0057], discloses that such a nozzle arrangement enables a series of processes (treating, developing, cleaning etc) to be performed, is moveable vertically and horizontally to discharge a fluid while scanning the substrate, and dispenses the fluid in a uniform amount on the surface of the substrate.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is

(571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ddc
MM

February 16, 2006.



JOHN A. MCPHERSON
PRIMARY EXAMINER